SEQUENCE LISTING

<110> Steiger, Sabine
Sandmann, Gerhard

<120> Method for producing ketocarotenoids by cultivating genetically modified organisms

<130> 12810-00106-US

<150> PCT/EP2003/014876
<151> 2003-12-24

<150> DE 103 00 649.4
<151> 2003-01-09

<160> 15

<170> PatentIn version 3.3

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tta agt gct aaa gaa gat act gtt tgg ggg ctg gtg att gtc ata gta       96
Leu Ser Ala Lys Glu Asp Thr Val Trp Gly Leu Val Ile Val Ile Val
            20                  25                  30

att att agt ctt tgg gta gct agt ttg gct ttt tta cta gct att aat      144
Ile Ile Ser Leu Trp Val Ala Ser Leu Ala Phe Leu Leu Ala Ile Asn
        35                  40                  45

tat gcc aaa gtc cca att tgg ttg ata cct att gca ata gtt tgg caa      192
Tyr Ala Lys Val Pro Ile Trp Leu Ile Pro Ile Ala Ile Val Trp Gln
    50                  55                  60

atg ttc ctt tat aca ggg cta ttt att act gca cat gat gct atg cat      240
Met Phe Leu Tyr Thr Gly Leu Phe Ile Thr Ala His Asp Ala Met His
65                  70                  75                  80

ggg tca gtt tat cgt aaa aat ccc aaa att aat aat ttt atc ggt tca      288
Gly Ser Val Tyr Arg Lys Asn Pro Lys Ile Asn Asn Phe Ile Gly Ser
                85                  90                  95

cta gct gta gcg ctt tac gct gtg ttt cca tat caa cag atg tta aag      336
Leu Ala Val Ala Leu Tyr Ala Val Phe Pro Tyr Gln Gln Met Leu Lys
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aat cat tgc tta cat cat cgt cat cct gct agc gaa gtt gac cca gat      384
Asn His Cys Leu His His Arg His Pro Ala Ser Glu Val Asp Pro Asp
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ttt cat gat ggt aag aga aca aac gct att ttc tgg tat ctc cat ttc      432
Phe His Asp Gly Lys Arg Thr Asn Ala Ile Phe Trp Tyr Leu His Phe
    130                 135                 140

atg ata gaa tac tcc agt tgg caa cag tta ata gta cta act atc cta      480
Met Ile Glu Tyr Ser Ser Trp Gln Gln Leu Ile Val Leu Thr Ile Leu
145                 150                 155                 160

ttt aat tta gct aaa tac gtt ttg cac atc cat caa ata aat ctc atc      528
Phe Asn Leu Ala Lys Tyr Val Leu His Ile His Gln Ile Asn Leu Ile
                165                 170                 175

tta ttt tgg agt att cct cca att tta agt tcc att caa ctg ttt tat      576
Leu Phe Trp Ser Ile Pro Pro Ile Leu Ser Ser Ile Gln Leu Phe Tyr
            180                 185                 190

ttc gga aca ttt ttg cct cat cga gaa ccc aag aaa gga tat gtt tat      624
Phe Gly Thr Phe Leu Pro His Arg Glu Pro Lys Lys Gly Tyr Val Tyr
        195                 200                 205

ccc cat tgc agc caa aca ata aaa ttg cca act ttt ttg tca ttt atc      672
Pro His Cys Ser Gln Thr Ile Lys Leu Pro Thr Phe Leu Ser Phe Ile
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gct tgc tac cac ttt ggt tat cat gaa gaa cat cat gag tat ccc cat      720
Ala Cys Tyr His Phe Gly Tyr His Glu Glu His His Glu Tyr Pro His
225                 230                 235                 240

gta cct tgg tgg caa ctt cca tct gta tat aag cag aga gta ttc aac      768
Val Pro Trp Trp Gln Leu Pro Ser Val Tyr Lys Gln Arg Val Phe Asn
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Tyr Ala Lys Val Pro Ile Trp Leu Ile Pro Ile Ala Ile Val Trp Gln
50 55 60

Met Phe Leu Tyr Thr Gly Leu Phe Ile Thr Ala His Asp Ala Met His
65 70 75 80

Gly Ser Val Tyr Arg Lys Asn Pro Lys Ile Asn Asn Phe Ile Gly Ser
85 90 95

Leu Ala Val Ala Leu Tyr Ala Val Phe Pro Tyr Gln Gln Met Leu Lys
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Asn His Cys Leu His His Arg His Pro Ala Ser Glu Val Asp Pro Asp
115 120 125

Phe His Asp Gly Lys Arg Thr Asn Ala Ile Phe Trp Tyr Leu His Phe
130 135 140

Met Ile Glu Tyr Ser Ser Trp Gln Gln Leu Ile Val Leu Thr Ile Leu
145 150 155 160

Phe Asn Leu Ala Lys Tyr Val Leu His Ile His Gln Ile Asn Leu Ile
165 170 175

Leu Phe Trp Ser Ile Pro Pro Ile Leu Ser Ser Ile Gln Leu Phe Tyr
180 185 190

Phe Gly Thr Phe Leu Pro His Arg Glu Pro Lys Lys Gly Tyr Val Tyr
195 200 205

Pro His Cys Ser Gln Thr Ile Lys Leu Pro Thr Phe Leu Ser Phe Ile
210 215 220

Ala Cys Tyr His Phe Gly Tyr His Glu Glu His His Glu Tyr Pro His
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1               5                   10                  15

gta ctg aga agt aaa tct cag ttt aag ggg ctt ttc att gct att gtc       96
Val Leu Arg Ser Lys Ser Gln Phe Lys Gly Leu Phe Ile Ala Ile Val
            20                  25                  30

att gtt agc gca tgg gtc att agc ctg agt tta tta ctt tcc ctt gac      144
Ile Val Ser Ala Trp Val Ile Ser Leu Ser Leu Leu Leu Ser Leu Asp
        35                  40                  45

atc tca aag cta aaa ttt tgg atg tta ttg cct gtt ata cta tgg caa      192
Ile Ser Lys Leu Lys Phe Trp Met Leu Leu Pro Val Ile Leu Trp Gln
    50                  55                  60

aca ttt tta tat acg gga tta ttt att aca tct cat gat gcc atg cat      240
Thr Phe Leu Tyr Thr Gly Leu Phe Ile Thr Ser His Asp Ala Met His
65                  70                  75                  80

ggc gta gta ttt ccc caa aac acc aag att aat cat ttg att gga aca      288
Gly Val Val Phe Pro Gln Asn Thr Lys Ile Asn His Leu Ile Gly Thr
                85                  90                  95

ttg acc cta tcc ctt tat ggt ctt tta cca tat caa aaa cta ttg aaa      336
Leu Thr Leu Ser Leu Tyr Gly Leu Leu Pro Tyr Gln Lys Leu Leu Lys
            100                 105                 110

aaa cat tgg tta cac cac cac aat cca gca agc tca ata gac ccg gat      384
Lys His Trp Leu His His His Asn Pro Ala Ser Ser Ile Asp Pro Asp
        115                 120                 125

ttt cac aat ggt aaa cac caa agt ttc ttt gct tgg tat ttt cat ttt      432
Phe His Asn Gly Lys His Gln Ser Phe Phe Ala Trp Tyr Phe His Phe
    130                 135                 140

atg aaa ggt tac tgg agt tgg ggg caa ata att gcg ttg act att att      480
Met Lys Gly Tyr Trp Ser Trp Gly Gln Ile Ile Ala Leu Thr Ile Ile
145                 150                 155                 160

tat aac ttt gct aaa tac ata ctc cat atc cca agt gat aat cta act      528
Tyr Asn Phe Ala Lys Tyr Ile Leu His Ile Pro Ser Asp Asn Leu Thr
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                165                 170                 175

tac ttt tgg gtg cta ccc tcg ctt tta agt tca tta caa tta ttc tat      576
Tyr Phe Trp Val Leu Pro Ser Leu Leu Ser Ser Leu Gln Leu Phe Tyr
            180                 185                 190

ttt ggt act ttt tta ccc cat agt gaa cca ata ggg ggt tat gtt cag      624
Phe Gly Thr Phe Leu Pro His Ser Glu Pro Ile Gly Gly Tyr Val Gln
        195                 200                 205

cct cat tgt gcc caa aca att agc cgt cct att tgg tgg tca ttt atc      672
Pro His Cys Ala Gln Thr Ile Ser Arg Pro Ile Trp Trp Ser Phe Ile
    210                 215                 220

acg tgc tat cat ttt ggc tac cac gag gaa cat cac gaa tat cct cat      720
Thr Cys Tyr His Phe Gly Tyr His Glu Glu His His Glu Tyr Pro His
225                 230                 235                 240

att tct tgg tgg cag tta cca gaa att tac aaa gca aaa tag              762
Ile Ser Trp Trp Gln Leu Pro Glu Ile Tyr Lys Ala Lys
                245                 250
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            20                  25                  30

Ile Val Ser Ala Trp Val Ile Ser Leu Ser Leu Leu Leu Ser Leu Asp
        35                  40                  45

Ile Ser Lys Leu Lys Phe Trp Met Leu Leu Pro Val Ile Leu Trp Gln
    50                  55                  60

Thr Phe Leu Tyr Thr Gly Leu Phe Ile Thr Ser His Asp Ala Met His
65                  70                  75                  80

Gly Val Val Phe Pro Gln Asn Thr Lys Ile Asn His Leu Ile Gly Thr
                85                  90                  95

Leu Thr Leu Ser Leu Tyr Gly Leu Leu Pro Tyr Gln Lys Leu Leu Lys
            100                 105                 110
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Lys His Trp Leu His His His Asn Pro Ala Ser Ser Ile Asp Pro Asp
115 120 125

Phe His Asn Gly Lys His Gln Ser Phe Phe Ala Trp Tyr Phe His Phe
130 135 140

Met Lys Gly Tyr Trp Ser Trp Gly Gln Ile Ile Ala Leu Thr Ile Ile
145 150 155 160

Tyr Asn Phe Ala Lys Tyr Ile Leu His Ile Pro Ser Asp Asn Leu Thr
165 170 175

Tyr Phe Trp Val Leu Pro Ser Leu Leu Ser Ser Leu Gln Leu Phe Tyr
180 185 190

Phe Gly Thr Phe Leu Pro His Ser Glu Pro Ile Gly Gly Tyr Val Gln
195 200 205

Pro His Cys Ala Gln Thr Ile Ser Arg Pro Ile Trp Trp Ser Phe Ile
210 215 220

Thr Cys Tyr His Phe Gly Tyr His Glu Glu His His Glu Tyr Pro His
225 230 235 240

Ile Ser Trp Trp Gln Leu Pro Glu Ile Tyr Lys Ala Lys
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ggc cca cct cct cat ctc cat cgg tca ttt gct gct acc acg atg ctg 95
Gly Pro Pro Pro His Leu His Arg Ser Phe Ala Ala Thr Thr Met Leu
20 25 30

tcg aag ctg cag tca atc agc gtc aag gcc cgc cgc gtt gaa cta gcc 143
Ser Lys Leu Gln Ser Ile Ser Val Lys Ala Arg Arg Val Glu Leu Ala

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                35                  40                  45

cgc gac atc acg cgg ccc aaa gtc tgc ctg cat gct cag cgg tgc tcg      191
Arg Asp Ile Thr Arg Pro Lys Val Cys Leu His Ala Gln Arg Cys Ser
        50                  55                  60

tta gtt cgg ctg cga gtg gca gca cca cag aca gag gag gcg ctg gga      239
Leu Val Arg Leu Arg Val Ala Ala Pro Gln Thr Glu Glu Ala Leu Gly
    65                  70                  75

acc gtg cag gct gcc ggc gcg ggc gat gag cac agc gcc gat gta gca      287
Thr Val Gln Ala Ala Gly Ala Gly Asp Glu His Ser Ala Asp Val Ala
80                  85                  90                  95

ctc cag cag ctt gac cgg gct atc gca gag cgt cgt gcc cgg cgc aaa      335
Leu Gln Gln Leu Asp Arg Ala Ile Ala Glu Arg Arg Ala Arg Arg Lys
                100                 105                 110

cgg gag cag ctg tca tac cag gct gcc gcc att gca gca tca att ggc      383
Arg Glu Gln Leu Ser Tyr Gln Ala Ala Ala Ile Ala Ala Ser Ile Gly
            115                 120                 125

gtg tca ggc att gcc atc ttc gcc acc tac ctg aga ttt gcc atg cac      431
Val Ser Gly Ile Ala Ile Phe Ala Thr Tyr Leu Arg Phe Ala Met His
        130                 135                 140

atg acc gtg ggc ggc gca gtg cca tgg ggt gaa gtg gct ggc act ctc      479
Met Thr Val Gly Gly Ala Val Pro Trp Gly Glu Val Ala Gly Thr Leu
    145                 150                 155

ctc ttg gtg gtt ggt ggc gcg ctc ggc atg gag atg tat gcc cgc tat      527
Leu Leu Val Val Gly Gly Ala Leu Gly Met Glu Met Tyr Ala Arg Tyr
160                 165                 170                 175

gca cac aaa gcc atc tgg cat gag tcg cct ctg ggc tgg ctg ctg cac      575
Ala His Lys Ala Ile Trp His Glu Ser Pro Leu Gly Trp Leu Leu His
                180                 185                 190

aag agc cac cac aca cct cgc act gga ccc ttt gaa gcc aac gac ttg      623
Lys Ser His His Thr Pro Arg Thr Gly Pro Phe Glu Ala Asn Asp Leu
            195                 200                 205

ttt gca atc atc aat gga ctg ccc gcc atg ctc ctg tgt acc ttt ggc      671
Phe Ala Ile Ile Asn Gly Leu Pro Ala Met Leu Leu Cys Thr Phe Gly
        210                 215                 220

ttc tgg ctg ccc aac gtc ctg ggg gcg gcc tgc ttt gga gcg ggg ctg      719
Phe Trp Leu Pro Asn Val Leu Gly Ala Ala Cys Phe Gly Ala Gly Leu
    225                 230                 235

ggc atc acg cta tac ggc atg gca tat atg ttt gta cac gat ggc ctg      767
Gly Ile Thr Leu Tyr Gly Met Ala Tyr Met Phe Val His Asp Gly Leu
240                 245                 250                 255

gtg cac agg cgc ttt ccc acc ggg ccc atc gct ggc ctg ccc tac atg      815
Val His Arg Arg Phe Pro Thr Gly Pro Ile Ala Gly Leu Pro Tyr Met
                260                 265                 270
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aag cgc ctg aca gtg gcc cac cag cta cac cac agc ggc aag tac ggt 863
Lys Arg Leu Thr Val Ala His Gln Leu His His Ser Gly Lys Tyr Gly
275 280 285

ggc gcg ccc tgg ggt atg ttc ttg ggt cca cag gag ctg cag cac att 911
Gly Ala Pro Trp Gly Met Phe Leu Gly Pro Gln Glu Leu Gln His Ile
290 295 300

cca ggt gcg gcg gag gag gtg gag cga ctg gtc ctg gaa ctg gac tgg 959
Pro Gly Ala Ala Glu Glu Val Glu Arg Leu Val Leu Glu Leu Asp Trp
305 310 315

tcc aag cgg tag ggtgcggaac caggcacgct ggtttcacac ctcatgcctg 1011
Ser Lys Arg
320

tgataaggtg tggctagagc gatgcgtgtg agacgggtat gtcacggtcg actggtctga 1071

tggccaatgg catcggccat gtctggtcat cacgggctgg ttgcctgggt gaaggtgatg 1131

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ggctcgtgcc agaaatggtg agtggatgac tgtgacgctg tacattgcag gcaggtgaga 1551

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35 40 45

Asp Ile Thr Arg Pro Lys Val Cys Leu His Ala Gln Arg Cys Ser Leu
50 55 60

Val Arg Leu Arg Val Ala Ala Pro Gln Thr Glu Glu Ala Leu Gly Thr
65 70 75 80

Val Gln Ala Ala Gly Ala Gly Asp Glu His Ser Ala Asp Val Ala Leu
85 90 95

Gln Gln Leu Asp Arg Ala Ile Ala Glu Arg Arg Ala Arg Arg Lys Arg
100 105 110

Glu Gln Leu Ser Tyr Gln Ala Ala Ala Ile Ala Ala Ser Ile Gly Val
115 120 125

Ser Gly Ile Ala Ile Phe Ala Thr Tyr Leu Arg Phe Ala Met His Met
130 135 140

Thr Val Gly Gly Ala Val Pro Trp Gly Glu Val Ala Gly Thr Leu Leu
145 150 155 160

Leu Val Val Gly Gly Ala Leu Gly Met Glu Met Tyr Ala Arg Tyr Ala
165 170 175

His Lys Ala Ile Trp His Glu Ser Pro Leu Gly Trp Leu Leu His Lys
180 185 190

Ser His His Thr Pro Arg Thr Gly Pro Phe Glu Ala Asn Asp Leu Phe
195 200 205

Ala Ile Ile Asn Gly Leu Pro Ala Met Leu Leu Cys Thr Phe Gly Phe
210 215 220

Trp Leu Pro Asn Val Leu Gly Ala Ala Cys Phe Gly Ala Gly Leu Gly
225 230 235 240

Ile Thr Leu Tyr Gly Met Ala Tyr Met Phe Val His Asp Gly Leu Val
245 250 255

His Arg Arg Phe Pro Thr Gly Pro Ile Ala Gly Leu Pro Tyr Met Lys
260 265 270

Arg Leu Thr Val Ala His Gln Leu His His Ser Gly Lys Tyr Gly Gly

275 280 285

Ala Pro Trp Gly Met Phe Leu Gly Pro Gln Glu Leu Gln His Ile Pro
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Lys Arg

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<213> Lycopersicon esculentum

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Met Asp
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act ttg ttg aaa acc cca aat aac ctt gaa ttt ctg aac cca cat cat 165
Thr Leu Leu Lys Thr Pro Asn Asn Leu Glu Phe Leu Asn Pro His His
5 10 15

ggt ttt gct gtt aaa gct agt acc ttt aga tct gag aag cat cat aat 213
Gly Phe Ala Val Lys Ala Ser Thr Phe Arg Ser Glu Lys His His Asn
20 25 30

ttt ggt tct agg aag ttt tgt gaa act ttg ggt aga agt gtt tgt gtt 261
Phe Gly Ser Arg Lys Phe Cys Glu Thr Leu Gly Arg Ser Val Cys Val
35 40 45 50

aag ggt agt agt agt gct ctt tta gag ctt gta cct gag acc aaa aag 309
Lys Gly Ser Ser Ser Ala Leu Leu Glu Leu Val Pro Glu Thr Lys Lys
55 60 65

gag aat ctt gat ttt gag ctt cct atg tat gac cct tca aaa ggg gtt 357
Glu Asn Leu Asp Phe Glu Leu Pro Met Tyr Asp Pro Ser Lys Gly Val
70 75 80

gtt gtg gat ctt gct gtg gtt ggt ggt ggc cct gca gga ctt gct gtt 405
Val Val Asp Leu Ala Val Val Gly Gly Gly Pro Ala Gly Leu Ala Val
85 90 95

gca cag caa gtt tct gaa gca gga ctc tct gtt tgt tca att gat ccg 453

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Ala Gln Gln Val Ser Glu Ala Gly Leu Ser Val Cys Ser Ile Asp Pro
    100                 105                 110

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Asn Pro Lys Leu Ile Trp Pro Asn Asn Tyr Gly Val Trp Val Asp Glu
115                 120                 125                 130

ttt gag gct atg gac ttg tta gat tgt cta gat gct acc tgg tct ggt      549
Phe Glu Ala Met Asp Leu Leu Asp Cys Leu Asp Ala Thr Trp Ser Gly
                135                 140                 145

gca gca gtg tac att gat gat aat acg gct aaa gat ctt cat aga cct      597
Ala Ala Val Tyr Ile Asp Asp Asn Thr Ala Lys Asp Leu His Arg Pro
            150                 155                 160

tat gga agg gtt aac cgg aaa cag ctg aaa tcg aaa atg atg cag aaa      645
Tyr Gly Arg Val Asn Arg Lys Gln Leu Lys Ser Lys Met Met Gln Lys
        165                 170                 175

tgt ata atg aat ggt gtt aaa ttc cac caa gcc aaa gtt ata aag gtg      693
Cys Ile Met Asn Gly Val Lys Phe His Gln Ala Lys Val Ile Lys Val
    180                 185                 190

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Ile His Glu Glu Ser Lys Ser Met Leu Ile Cys Asn Asp Gly Ile Thr
195                 200                 205                 210

att cag gca acg gtg gtg ctc gat gca act ggc ttc tct aga tct ctt      789
Ile Gln Ala Thr Val Val Leu Asp Ala Thr Gly Phe Ser Arg Ser Leu
                215                 220                 225

gtt cag tat gat aag cct tat aac ccc ggg tat caa gtt gct tat ggc      837
Val Gln Tyr Asp Lys Pro Tyr Asn Pro Gly Tyr Gln Val Ala Tyr Gly
            230                 235                 240

att ttg gct gaa gtg gaa gag cac ccc ttt gat gta aac aag atg gtt      885
Ile Leu Ala Glu Val Glu Glu His Pro Phe Asp Val Asn Lys Met Val
        245                 250                 255

ttc atg gat tgg cga gat tct cat ttg aag aac aat act gat ctc aag      933
Phe Met Asp Trp Arg Asp Ser His Leu Lys Asn Asn Thr Asp Leu Lys
    260                 265                 270

gag aga aat agt aga ata cca act ttt ctt tat gca atg cca ttt tca      981
Glu Arg Asn Ser Arg Ile Pro Thr Phe Leu Tyr Ala Met Pro Phe Ser
275                 280                 285                 290

tcc aac agg ata ttt ctt gaa gaa aca tca ctc gta gct cgt cct ggc     1029
Ser Asn Arg Ile Phe Leu Glu Glu Thr Ser Leu Val Ala Arg Pro Gly
                295                 300                 305

ttg cgt ata gat gat att caa gaa cga atg gtg gct cgt tta aac cat     1077
Leu Arg Ile Asp Asp Ile Gln Glu Arg Met Val Ala Arg Leu Asn His
            310                 315                 320

ttg ggg ata aaa gtg aag agc att gaa gaa gat gaa cat tgt cta ata     1125
Leu Gly Ile Lys Val Lys Ser Ile Glu Glu Asp Glu His Cys Leu Ile
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        325                 330                 335

cca atg ggt ggt cca ctt cca gta tta cct cag aga gtc gtt gga atc     1173
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    340                 345                 350

ggt ggt aca gct ggc atg gtt cat cca tcc acc ggt tat atg gtg gca     1221
Gly Gly Thr Ala Gly Met Val His Pro Ser Thr Gly Tyr Met Val Ala
355                 360                 365                 370

agg aca cta gct gcg gct cct gtt gtt gcc aat gcc ata att caa tac     1269
Arg Thr Leu Ala Ala Ala Pro Val Val Ala Asn Ala Ile Ile Gln Tyr
                375                 380                 385

ctc ggt tct gaa aga agt cat tcg ggt aat gaa tta tcc aca gct gtt     1317
Leu Gly Ser Glu Arg Ser His Ser Gly Asn Glu Leu Ser Thr Ala Val
            390                 395                 400

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Trp Lys Asp Leu Trp Pro Ile Glu Arg Arg Arg Gln Arg Glu Phe Phe
        405                 410                 415

tgc ttc ggt atg gat att ctt ctg aag ctt gat tta cct gct aca aga     1413
Cys Phe Gly Met Asp Ile Leu Leu Lys Leu Asp Leu Pro Ala Thr Arg
    420                 425                 430

agg ttc ttt gat gca ttc ttt gac tta gaa cct cgt tat tgg cat ggc     1461
Arg Phe Phe Asp Ala Phe Phe Asp Leu Glu Pro Arg Tyr Trp His Gly
435                 440                 445                 450

ttc tta tcg tct cga ttg ttt cta cct gaa ctc ata gtt ttt ggg ctg     1509
Phe Leu Ser Ser Arg Leu Phe Leu Pro Glu Leu Ile Val Phe Gly Leu
                455                 460                 465

tct cta ttc tct cat gct tca aat act tct aga ttt gag ata atg aca     1557
Ser Leu Phe Ser His Ala Ser Asn Thr Ser Arg Phe Glu Ile Met Thr
            470                 475                 480

aag gga act gtt cca tta gta aat atg atc aac aat ttg tta cag gat     1605
Lys Gly Thr Val Pro Leu Val Asn Met Ile Asn Asn Leu Leu Gln Asp
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Lys Glu
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<400> 8

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His Asn Phe Gly Ser Arg Lys Phe Cys Glu Thr Leu Gly Arg Ser Val
35 40 45

Cys Val Lys Gly Ser Ser Ser Ala Leu Leu Glu Leu Val Pro Glu Thr
50 55 60

Lys Lys Glu Asn Leu Asp Phe Glu Leu Pro Met Tyr Asp Pro Ser Lys
65 70 75 80

Gly Val Val Val Asp Leu Ala Val Val Gly Gly Gly Pro Ala Gly Leu
85 90 95

Ala Val Ala Gln Gln Val Ser Glu Ala Gly Leu Ser Val Cys Ser Ile
100 105 110

Asp Pro Asn Pro Lys Leu Ile Trp Pro Asn Asn Tyr Gly Val Trp Val
115 120 125

Asp Glu Phe Glu Ala Met Asp Leu Leu Asp Cys Leu Asp Ala Thr Trp
130 135 140

Ser Gly Ala Ala Val Tyr Ile Asp Asp Asn Thr Ala Lys Asp Leu His
145 150 155 160

Arg Pro Tyr Gly Arg Val Asn Arg Lys Gln Leu Lys Ser Lys Met Met
165 170 175

Gln Lys Cys Ile Met Asn Gly Val Lys Phe His Gln Ala Lys Val Ile
180 185 190

Lys Val Ile His Glu Glu Ser Lys Ser Met Leu Ile Cys Asn Asp Gly
195 200 205

Ile Thr Ile Gln Ala Thr Val Val Leu Asp Ala Thr Gly Phe Ser Arg
210 215 220

Ser Leu Val Gln Tyr Asp Lys Pro Tyr Asn Pro Gly Tyr Gln Val Ala
225 230 235 240

Tyr Gly Ile Leu Ala Glu Val Glu Glu His Pro Phe Asp Val Asn Lys
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Met Val Phe Met Asp Trp Arg Asp Ser His Leu Lys Asn Asn Thr Asp
260 265 270

Leu Lys Glu Arg Asn Ser Arg Ile Pro Thr Phe Leu Tyr Ala Met Pro
275 280 285

Phe Ser Ser Asn Arg Ile Phe Leu Glu Glu Thr Ser Leu Val Ala Arg
290 295 300

Pro Gly Leu Arg Ile Asp Asp Ile Gln Glu Arg Met Val Ala Arg Leu
305 310 315 320

Asn His Leu Gly Ile Lys Val Lys Ser Ile Glu Glu Asp Glu His Cys
325 330 335

Leu Ile Pro Met Gly Gly Pro Leu Pro Val Leu Pro Gln Arg Val Val
340 345 350

Gly Ile Gly Gly Thr Ala Gly Met Val His Pro Ser Thr Gly Tyr Met
355 360 365

Val Ala Arg Thr Leu Ala Ala Ala Pro Val Val Ala Asn Ala Ile Ile
370 375 380

Gln Tyr Leu Gly Ser Glu Arg Ser His Ser Gly Asn Glu Leu Ser Thr
385 390 395 400

Ala Val Trp Lys Asp Leu Trp Pro Ile Glu Arg Arg Arg Gln Arg Glu
405 410 415

Phe Phe Cys Phe Gly Met Asp Ile Leu Leu Lys Leu Asp Leu Pro Ala
420 425 430

Thr Arg Arg Phe Phe Asp Ala Phe Phe Asp Leu Glu Pro Arg Tyr Trp
435 440 445

His Gly Phe Leu Ser Ser Arg Leu Phe Leu Pro Glu Leu Ile Val Phe
450 455 460

Gly Leu Ser Leu Phe Ser His Ala Ser Asn Thr Ser Arg Phe Glu Ile

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Met Thr Lys Gly Thr Val Pro Leu Val Asn Met Ile Asn Asn Leu Leu
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Gln Asp Lys Glu
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actgagactg cggggatcc 259